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**A1R314C1D A1R409 A1R460 A20T14**

(56) Documents Cited

**EP 0508645 A EP 0448876 A2 WO 99/20450 A1**  
**WO 94/08716 A1 WO 86/07606 A1 JP 700214593 A**  
**US 5474742 A**

(58) Field of Search

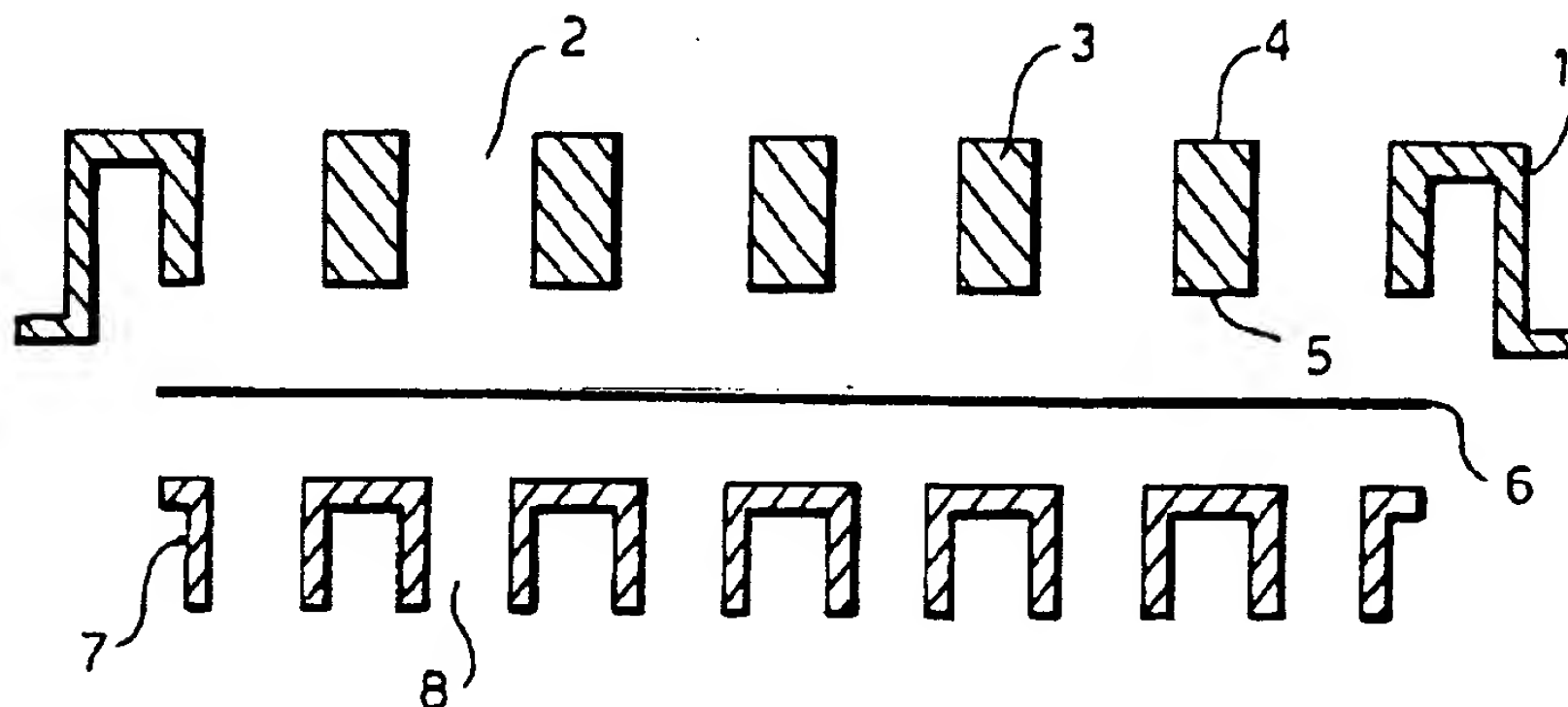
**UK CL (Edition Q) B5A AB12 AB13 AB19 AB22 AB23**  
**INT CL<sup>6</sup> B29C 45/14**  
**Online: WPI EPODOC JAPIO**

(54) Abstract Title

**Moulded filter plates**

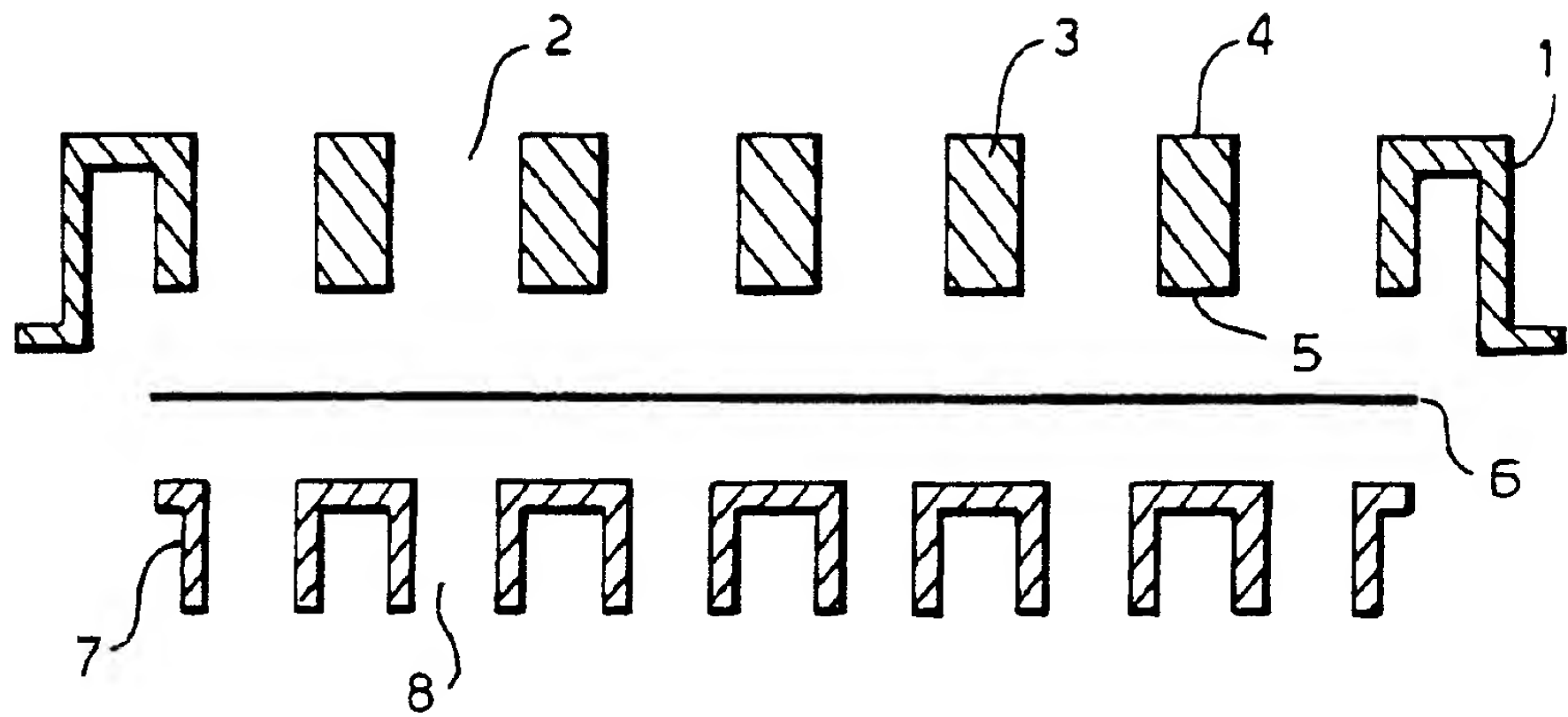
(57) The invention relates to a multiwell plate 1 where the base of each well 2 consists of a filter material 6 which is fixed to the plate by means of an insert moulding process. Another plate 7 is bonded to the filter material 6 and the plate 1 to provide exit tubes 8 below the filter and in line with each well.

Fig.1



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Fig.1



## FILTER PLATES

### Summary of Invention

This invention relates to a multiwell plate where the base of each well consists of a filter material which is fixed to the plate by means of an insert moulding process.

### Background

Multiwell plates have been used for many years in clinical and other laboratories for simultaneous analysis of a number of samples. Typical formats include 4, 24, 48, 96 and 384 wells per plate. Initially, these plates had solid bases integrally moulded and liquid samples were pipetted into and out of the wells.

Plates with bases made from microporous membranes or other filter materials were developed in the 1980's. These 'filter plates' gave a number of advantages over the solid bottomed versions.

a) The through flow nature of use meant larger sample volumes could be processed since the sample size was not limited to the capacity of the well.

b) Assays involving the use of reactive chemistry, such as immunoassays, became significantly more sensitive with the use of membranes. This is because the membranes have a much greater surface area in which to attach the reactant and the flow across the whole area increases the chance of an analyte seeing the reactant compared to when it is bound to the relatively low surface area of a solid bottomed plate.

c) The filter also enables solid particulate to be separated out of a liquid as it passes through the well plate.

The methods previously used to attach the microporous materials to the base of the plate include ultrasonic welding, thermal fusion and mechanical clamping. These processes are carried out as a secondary operation to the injection moulding of the plate itself.

### The Invention

The invention we describe is a filter bottom plate whereby the filter is attached to the plate by means of moulding the plate over the pre-placed filter as an integral part of the injection moulding process (this process is known, generically, as 'insert moulding'). This eliminates the need for a separate process to attach the filter to the base of the plate, thus saving production time and double handling of materials. The new one-stage process also means that the finished product is produced at the first stage of processing, thus also eliminating the need for separate storage of moulded plates and filter materials prior to the bonding step. A further advantage of this insert moulding system is that it enables a fully automatic system to be used, when appropriate, whereby a continuous roll of the filter material is fed directly to the moulding machine and is cut to size and bonded to the plate as part of the process.

In a preferred embodiment, a sheet of filter material is cut which is large enough to cover all the wells of the plate at the bottom.

This sheet is placed in the mould tool and is retained until the mould closes around the sheet and it is then held firmly in place as molten plastic is injected into the mould and flows over it. The molten plastic then fuses into the filter material and bonds to it as it solidifies. Thus is produced a formed plastic plate which incorporates a plurality of wells whose bases are made of the filter material.

The plastic used for the plate can be polystyrene or polypropylene or a range of other thermoplastic materials. The filter material is typically a nylon or a nitro-cellulose membrane filter or a fibrous matt material of polypropylene or polyester but can also be another porous sheet material.

In another version, the insert moulded plate and filter described above is further bonded to a secondary plate under the filter material. This secondary plate incorporates conical or tubular spouts which direct the flow of liquid exiting from the base of the multiwell plate. This secondary plate is bonded to the primary plate by means of insert moulding or by other suitable means such as ultrasonic welding.

Reference is now made to the accompanying drawings:

Figure 1 is a partial section through a typical multiwell plate.

The plate 1 consists of a number of wells 2 which are enclosed by walls 3. The plate has a top surface 4 and the bottom surface of the walls of the wells is 5. The filter sheet material 6 is bonded to the bottom surface of the well walls and, in the second version, another plate 7 is further bonded to the filter material and the primary plate to provide exit tubes 8 below the filter and in line with each well.

**CLAIMS**

1. A method of manufacture of a filter bottomed plate whereby the filter is attached to the plate by means of moulding the plate over a pre-placed filter as an integral part of the injection moulding process.
2. A method as in Claim 1 where the injection moulding process uses a plastics material.
3. A method as in Claim 1 or 2 where the plastics material is polystyrene, polypropylene or another thermoplastic material
4. A method as in Claim 1 where the filter is nylon or nitrocellulose or other polymeric membrane filter material.
5. A method as in Claim 1 where the filter is a fibrous mat material such as polypropylene or polyester or another porous sheet material.
6. A method as described in Claims 1-5 where additionally a further plate is bonded to the insert moulded plate and filter construction to provide an exit structure.
7. A method as described in Claim 6 where bonding is by insert moulding or ultrasonic welding.

Amendments to the claims have been filed as follows

CLAIMS

1. A one step method of manufacture of a multiwell filter bottomed plate by injection moulding whereby the filter is bonded to the plate by means of moulding the plate over a pre-placed filter as an integral part of the injection moulding process.
2. A method as in Claim 1 where the injection moulding process uses a plastics material.
3. A method as in Claim 1 or 2 where the plastics material is polystyrene, polypropylene or another thermoplastic material
4. A method as in Claim 1 where the filter is nylon or nitro-cellulose or other polymeric membrane filter material.
5. A method as in Claim 1 where the filter is a fibrous mat material such as polypropylene or polyester or another porous sheet material.



Application No: GB 9906027.9  
Claims searched: 1-7

Examiner: Monty Siddique  
Date of search: 26 July 1999

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): B5A (AB12, AB13, AB19, AB22, AB23)

Int Cl (Ed.6): B29C 45/14

Other: Online: WPI EPODOC JAPIO

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X	EP0508645 A (GUTMAN RICHARD) plate-like in form	1-3, 4 at least
X	EP 0448876 A2 (MINNESOTA) column 8 lines 41-43 etc	1-3, 5 at least
X	WO 99/20450 A1 (MINNESOTA MINING) insert-moulding a plate-like article having a filter	1, 2, 5 at least
X	WO 94/08716 A1 (BAXTER) page 9 lines 9-15 at least	1-4 at least
X	WO 86/07606 A1 (GENEMED) claim 11 at least	1 at least
A	US 5474742 (TAMARA)	
X	JP 7214593 A (TOYODA) see abstract and drawing	1 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.